

CHROMOSOME NUMBERS IN SILENE
(CARYOPHYLLACEAE). II.

A. R. KRUCKEBERG¹

The accumulation of cytotaxonomic data from members of the subfamily Silenoideae (Caryophyllaceae) continues, with this second report adding chromosome numbers of thirty-two species counted for the first time. Additional records are given here for twenty of the species included in the first paper of this series (Kruckeberg, 1954). In all, the present report comprises chromosome counts for one hundred and fifty-six collections from continental North America, Hawaii, Europe, and Asia. The chromosome numbers are listed in Table 1; figures 1-28 are camera lucida drawings of chromosome complements for species hitherto uncounted.

Records of chromosome numbers of the Silenoideae are being accumulated for two reasons. Chromosome counts have intrinsic value as part of the total self-portrait of a taxon. Secondly, the ploidy level of any two populations qualifies the success with which those population samples can be used in hybridizations to determine species interfertilities (see Kruckeberg, 1955).

All counts have been made from squashes of microsporocytes handled in the manner outlined in Kruckeberg (1954). Most of the material I have collected in native habitats of western United States. Collections from eastern United States and from localities outside continental North America were kindly furnished by other botanists.

TABLE 1. DIPLOID CHROMOSOME NUMBERS IN LYCHNIS AND SILENE

WESTERN NORTH AMERICAN SPECIES	2n Chromosome Number	Number of Collections
<i>Lychnis drummondii</i> (Hook.) Wats.	48	5
<i>Silene aperta</i> Greene	48	1
<i>S. bridgesii</i> Rohrb.	48	1
<i>S. californica</i> Durand. Tetraploid	48	2
Hexaploid	72	1
<i>S. campanulata</i> Wats.	48	1
<i>S. clokeyi</i> H. & M.	96	1
<i>S. douglasii</i> Hook.	48	22
<i>S. grayi</i> Wats.	48	3
<i>S. hookeri</i> Nutt. ex T. & G.	72	3
<i>S. invisa</i> H. & M.	48	3
<i>S. laciniata</i> Cav. subsp. <i>major</i> H. & M. Octoploid	96	4
<i>S. laciniata</i> Cav. subsp. <i>greggii</i> (Gray) H. & M. Tetraploid	48	10
<i>S. lemmonii</i> Wats.	48	5

¹ Supported by funds from the State of Washington Initiative No. 171 and by the National Science Foundation, Grant G-1323.

	2n Chromosome Number	Number of Collections
<i>S. marmorensis</i> Kruck.	48	1
<i>S. menziesii</i> Hook. Diploid	24	2
Tetraploid	48	12
<i>S. montana</i> Wats.	48	4
<i>S. nuda</i> (Wats.) H. & M.	48	3
<i>S. nuda</i> subsp. <i>insectivora</i> (Hend.) H. & M.	48	1
<i>S. occidentalis</i> Wats.	48	1
<i>S. oregana</i> Wats.	48	1
<i>S. parishii</i> Wats.	48	3
<i>S. parryi</i> (Wats.) H. & M. Tetraploid	48	9
Octoploid	96	6
<i>S. petersonii</i> Maguire	96	2
<i>S. repens</i> Patrin subsp. <i>australe</i> H. & M.	24	2
<i>S. sargentii</i> Wats.	48	3
<i>S. scaposa</i> Robins.	48	1
<i>S. scouleri</i> Hook.	48	1
<i>S. spaldingii</i> Wats.	48	1
<i>S. thurberi</i> Wats.	48	1
<i>S. verecunda</i> Wats. subsp. <i>verecunda</i>	48	1
<i>S. verecunda</i> Wats. subsp. <i>andersonii</i> (Clokey) H. & M.	48	1
<i>S. verecunda</i> Wats. subsp. <i>platyota</i> (Wats.) H. & M.	48	10
<i>S. williamsii</i> Britt.	24	2
<i>S. wrightii</i> Gray	96	1
EASTERN NORTH AMERICAN SPECIES		
<i>Silene antirrhina</i> L.	24	1
<i>S. caroliniana</i> Walt.	48	2
<i>S. caroliniana</i> subsp. <i>wherryi</i> (Small) Clausen	48	1
<i>S. polypetala</i> (Walt.) Fern. & Schub.	48	1
<i>S. regia</i> Sims.	48	2
<i>S. rotundifolia</i> Nutt.	48	1
<i>S. stellata</i> (L.) Ait. <i>sensu lat.</i>	48	5
<i>S. subciliata</i> Robins.	48	1
<i>S. virginica</i> L.	48	1
SPECIES OUTSIDE CONTINENTAL NORTH AMERICA		
<i>Lychnis wilfordii</i> Maxim.	24	1
<i>Petrocoptis pyrenaica</i> Braun.	24	1
<i>Silene keiskei</i> Miq.	24	2
<i>S. repens</i> Patrin. var. <i>latifolia</i> Turcz.	48	2
<i>S. struthiolooides</i> Gray	24	1
<i>S. species</i> from Nepal	24	2

DISCUSSION

Having determined chromosome numbers for all but five of the thirty-three perennial species of *Silene* native to western North America, I am emboldened to make some guarded generalizations. Though chromosome numbers of the remaining uncounted species as well as any additional records for species previously counted may prove to be further exceptions, it seems safe to state that the tetraploid level ($2n=48$) is by far the common one among the western species. The tetraploid level is main-

tained even more rigidly for the eastern North American species. Apart from *S. ovata* and *S. nivea* (Nutt.) Otth., for which chromosome numbers are not yet known, the other seven eastern perennial species are uniformly tetraploid. The present data emphasize the observation made in an earlier paper (Kruckeberg, 1954)—namely, that North America is the home of the polyploids whereas the continental areas of Eurasia are inhabited predominantly by diploid species. At first glance, this geographic difference in average ploidy level might suggest that the Eurasian species were ancestral to the North American ones. The Siberia-Aleutian Islands land bridge, a path well beaten by the biogeographers—if not by the biota themselves—would seem the likely route. Yet one species for which I have obtained counts on both the Asian and North American plants defies the usual west-to-east migration route. *Silene repens* Patrin in Japan (var. *latifolia* Turcz.) is tetraploid while the North American variety, *australe* Hitch. & Maguire, is diploid. Therefore, I would offer an alternative hypothesis: North American polyploid species could have originated on this continent from diploids as a common phenomenon whereas polyploidy might have been a rare event among the ancestors of the Eurasian Silenes.

The present list of chromosome numbers permits tentative conclusions to be drawn about certain species.

1. *SILENE CALIFORNICA* DUR. AND *S. HOOKERI* NUTT. On morphological grounds it is easy to see a close relationship between *S. californica* and *S. hookeri*. The prostrate habit, the showy flowers (red versus pink), the characteristic geniculation of the pedicels in fruit, the large black seeds, and the partial sympatric distribution in the Coast Ranges and Siskiyou Mountains all suggest a close affinity. Up to now, though, I was convinced that the two species were isolated by a barrier of ploidy difference. *S. hookeri* is consistently hexaploid ($2n=72$) while most collections of *S. californica* have been tetraploid ($2n=48$). The discovery of a hexaploid *S. californica* population and the subsequent production of a fertile F_1 hybrid (to be discussed in a later paper) support my intuitive feeling that the two species are closely related.

2. THE THREE SUBSPECIES OF *SILENE LACINIATA* CAV. According to Hitchcock and Maguire (1943), three regional facies of *S. laciniata* occur in the southwest. *Silene laciniata* subsp. *laciniata* is widespread in Mexico, *S. laciniata* subsp. *major* H. & M. is confined to coastal southern California, and *S. laciniata* subsp. *greggii* (Gray) H. & M. occurs in Arizona, New Mexico, Texas, and adjacent northern Mexico. Subspecies *major* is octoploid ($2n=96$) while subsp. *greggii* is tetraploid ($2n=48$). Much wider sampling of this polymorphic species will be necessary before it can be fully evaluated cytotaxonomically. Since subsp. *major* and subsp. *greggii* are isolated both spatially and genetically, it becomes a moot question as to whether subsp. *greggii* should be restored to its former level of

species. The center of distribution of *S. laciniata* is undoubtedly in the plateau and mountain regions of north-central Mexico. Subspecies *greggii* is a mid-continent derivative from this center while subsp. *major* is the coastal segregate. Additional collections of *S. laciniata greggii*, made in Arizona, New Mexico, and Texas in the summer of 1959, proved also to be tetraploid. However, in the two weeks of searching in the Mexican states of Nuevo León and Chihuahua, I did not encounter any plants of *S. laciniata*, though the species is frequently reported from this section of México.

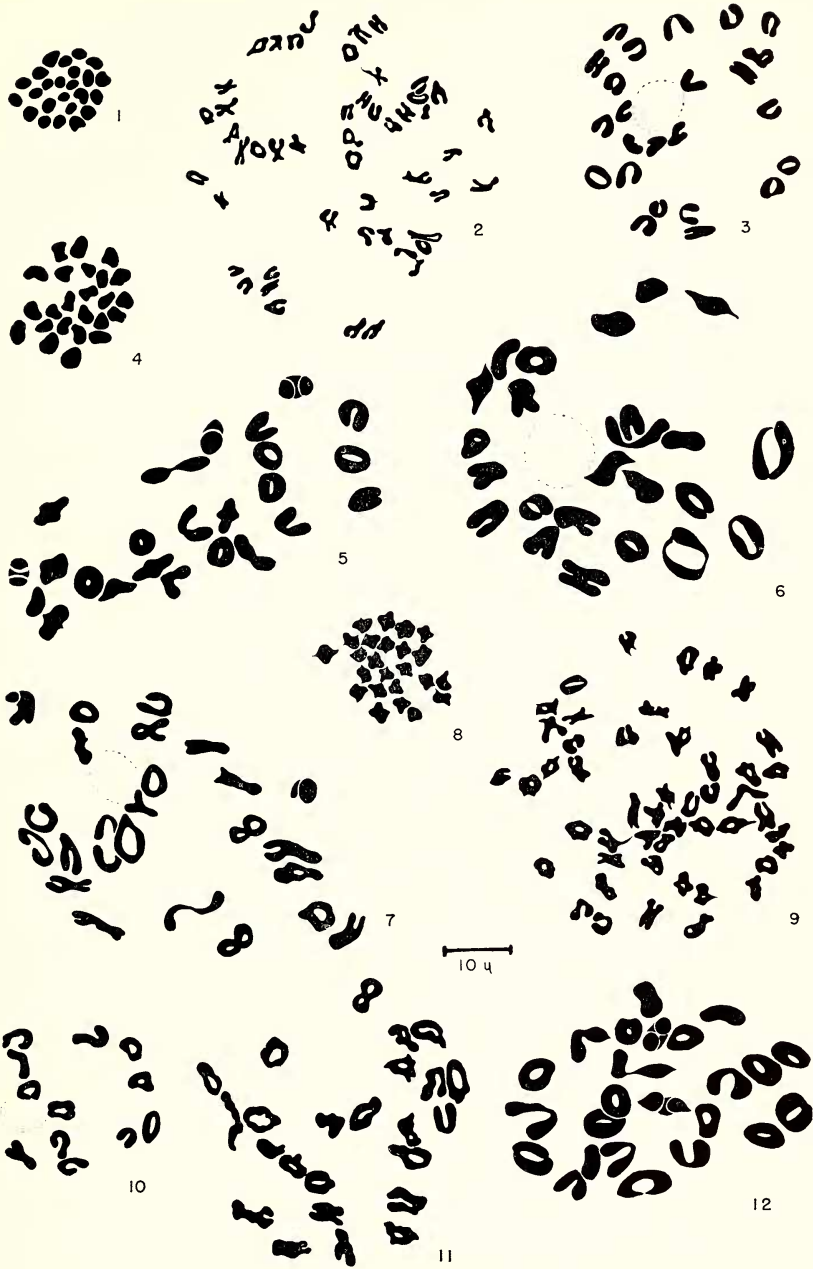
3. DIPLOID AND TETRAPLOID *SILENE MENZIESII* HOOK. Further sampling of this wide-ranging species reaffirms my earlier report (Kruckeberg, 1954) of the predominance of the tetraploid level ($2n=48$). As against twelve collections of tetraploids, only two diploid samples are recorded in this current listing. One of the diploids was collected in the Sierra Nevada of California and the other in central Idaho. It would appear that the distribution of diploids is random and their occurrence rare. It is possible that the tetraploids are autopolyploid in origin. The sporadic distribution of the diploids, plus the not infrequent occurrence of quadrivalent pairing in certain tetraploids lends support to this hypothesis. Amphiploid origin is less likely, even though the Idaho diploids do occur sympatrically with another diploid species, *S. repens* Patrin subsp. *australis* H. & M. Apart from being rhizomatous and having general vegetative similarity, North American *S. repens* is not too likely a parent for tetraploid *S. menziesii*.

4. TETRAPLOID AND OCTOPLOID *SILENE PARRYI* (WATS.) H. & M. With the present data it is now possible to define rather clearly the limits of the two ploidy levels in *S. parryi*. The tetraploid forms ($2n=48$) occur exclusively east of the crest of the Cascade Range, and then eastward to the mountains of northeastern Washington (and presumably northern Idaho), terminating in the Rocky Mountains of Montana and Canada². The octoploid segment ($2n=96$) of the species has a much more restricted distribution; as yet it has been found only along the Cascade Range and the Olympic Mountains of Washington.

² A collection of a tetraploid *parryi* made on Snowdrift Mountain in southern Idaho (Kruckeberg 4520) suggests that the tetraploid form extends southward along the Continental Divide.

EXPLANATION OF FIGURES 1-12

FIGS. 1-12. Chromosomes of *Silene* microsporocytes. FIG. 1. *S. aperta*, II M (Kruckeberg 3407). FIG. 2. *S. clokeyi*, Diak. (Kruckeberg 3911). FIG. 3. *S. grayi*, Diak. (Kruckeberg 3772). FIG. 4. *S. invisa*, I M (Kruckeberg 2897b). FIG. 5. *S. laciniata greggii*, Diak. (Kruckeberg 3878). FIG. 6. *S. lemmonii*, Diak. (Kruckeberg 3530). FIG. 7. *S. montana*, Diak. (Kruckeberg 3529). FIG. 8. *S. occidentalis*, I T (Kruckeberg 3696). FIG. 9. *S. petersonii*, Diak. (Kruckeberg 3904). FIG. 10. *S. repens australis*, Diak. (Kruckeberg 4290). FIG. 11. *S. scaposa*, Diak. (Kruckeberg 4031). FIG. 12. *S. spaldingii*, Diak. (Daubenmire, s.n.). Diak., diakinesis; I M, first metaphase; II M, second metaphase; I T, first telophase. →



FIGS. 1-12. Chromosomes of *Silene* microsporocytes.

5. *SILENE WILLIAMSII* BRITT., *S. SEELEYI* MORT. & THOMPS., AND *S. MENZIESII* HOOK. These three species are grouped together because of their close morphological kinship. *Silene williamsii* of central Alaska and *S. seeleyi* are both diploid so far as is known. The fact that some collections of *S. menziesii* are also diploid makes gene exchange among the three species potentially possible. Hitchcock and Maguire (1947, p. 48) speculate that exceptional specimens of *S. menziesii* from western Canada show "contamination" with *S. williamsii*. I have made artificial hybrids in various combinations with the three diploids; some of the hybrids are reasonably fertile. Details of these and other interspecific hybridizations will be discussed elsewhere.

GEOGRAPHIC DISTRIBUTION OF COLLECTIONS

The origin of each collection that provided a chromosome count is given below. All collections are represented by specimens deposited in the University of Washington Herbarium. To those botanists who collected living plant material for this study, the author wishes to express his sincere appreciation.

WESTERN NORTH AMERICAN SPECIES

LYCHNIS DRUMMONDII (Hook.) Wats. $2n=48$. ARIZONA. Apache County: 12 miles from Red Rock, Lukachukai Mountains, *Gould and Phillips 4835*. Coconino County: Head of Kaibab Trail, north rim of Grand Canyon, *Kruckeberg 3901*. NEVADA. Clark County: ridge along trail to Charleston Peak, *Kruckeberg 3910*. NEW MEXICO. Catron County: between Bursom Forest Camp and Willow Creek, Mogollon Mountains, *Kruckeberg 4658*; 5 miles northeast of Collins Park on road to the plains of St. Augustine, *Kruckeberg 4702*.

SILENE APERTA Greene. $2n=48$. CALIFORNIA. Tulare County: 1 mile west of Hockett Meadows, on trail to Atwell Mill, Sequoia National Park, *Kruckeberg 3407*.

SILENE BRIDGESII Rohrb. $2n=48$. CALIFORNIA. Tuolumne County: Hog Ranch, near Mather, *Pray s.n.*

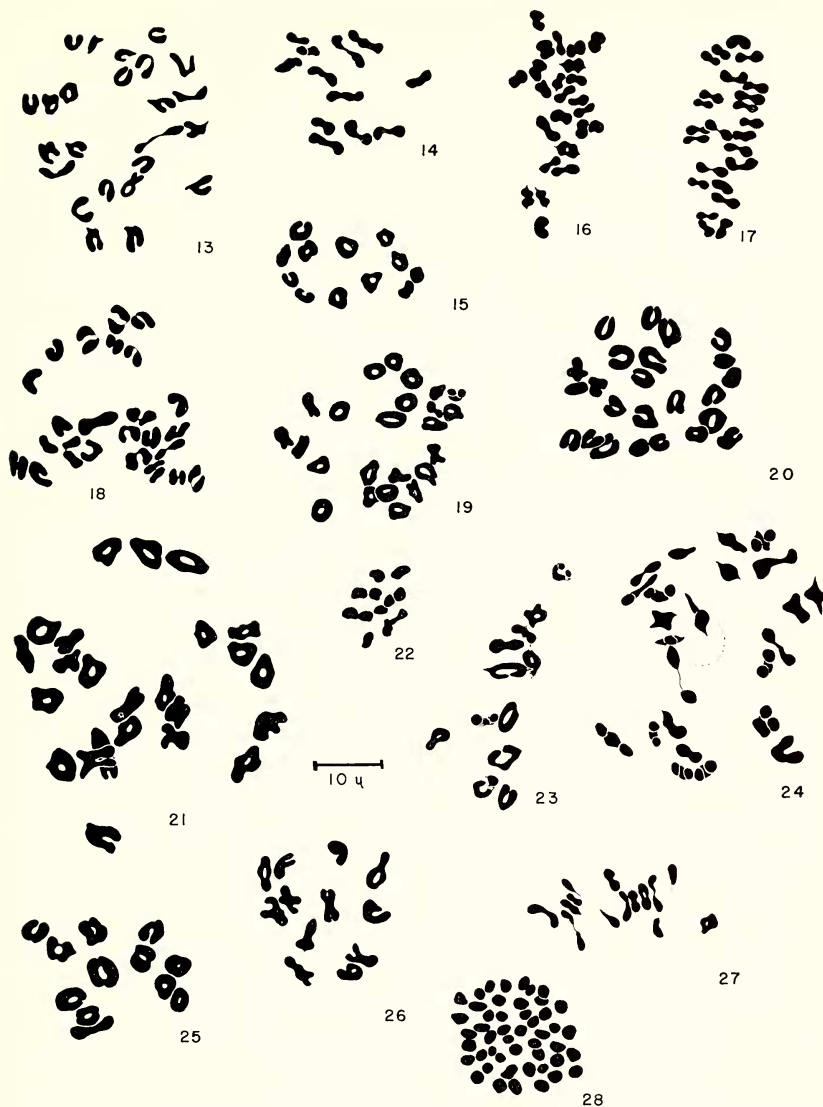
SILENE CALIFORNICA Durand. $2n=48$. Tetraploid. CALIFORNIA. Tulare County: Echo Point, near Moro Rock, Sequoia National Park, *Kruckeberg 3394*. Mendocino County: 4 miles north of Laytonville on U. S. Highway 101, *Kruckeberg 3918*.

SILENE CALIFORNICA Durand. $2n=72$. Hexaploid. CALIFORNIA. Del Norte County: gravel bar along Smith River at Gasquet, *Kruckeberg 3919*.

SILENE CAMPANULATA Wats. $2n=48$. CALIFORNIA. Siskiyou County: 12 miles southwest of Etna on Somes Bar road, *Hitchcock 20237*.

SILENE CLOKEYI H. & M. $2n=96$. NEVADA. Clark County: along ridge, 2 miles from summit of Charleston Peak, *Kruckeberg 3911*.

SILENE DOUGLASHII Hook. $2n=48$. CALIFORNIA. Plumas County: rocky flats above Elwell Lake, *Kruckeberg 2897*; rocky flats between Sand Lake and Packer Lake, near Sierra Buttes, *Kruckeberg 3697*. Trinity County: granite talus at Emerald Lake, Trinity Alps, *Kruckeberg 3743*; gravelly alluvium near Portuguese Camp between Emerald Lake and Morris Meadows, Trinity Alps, *Kruckeberg 3744*. OREGON. Benton County: grassy summit of Marys Peak, *Kruckeberg 2918*. Multnomah County: Larch Mountain, *Mrs. Mackaness, s.n.*; Bonneville, *Hitchcock s.n.* Clackamas County: ridge 0.5 miles east of Devils Peak, *Kruckeberg 4006*. IDAHO. Idaho County: Indian Hill lookout above Selway River, *Kruckeberg 4095*; granitic slopes above Canteen Meadows, Crags Mountains, *Kruckeberg 4137*; southeastern granitic rim of Crags Mountains, *Kruckeberg 4140*. Valley-Custer county line: rock crevices, Cape Horn Mountain, *Kruckeberg 4177*. Custer County: 2 miles east of Toxaway Lake, Sawtooth Mountains, *Kruckeberg 4198*; talus about Wild Horse Lakes, Mount Hyndman area,



FIGS. 13-28. Chromosomes of *Silene* microsporocytes. FIG. 13. *S. thurberi*, Diak. (Kruckeberg 3863). FIG. 14. *S. williamsii*, I M (Donnelly Dome, Gjaerevoll, s.n.). FIG. 15. *S. antirrhina*, Diak. (Palmer, s.n.). FIG. 16. *S. caroliniana*, I M (Channell, s.n.). FIG. 17. *S. caroliniana wherryi*, I M (Epstein, s.n.). FIG. 18. *S. polypetala*, Diak. (Galle, s.n.). FIG. 19. *S. regia*, Diak. (G. W. Carver National Monument, Palmer, s.n.). FIG. 20. *S. rotundifolia*, Diak. (Sherman, s.n.). FIG. 21. *S. subciliata*, Diak. (Dormon, s.n.). FIG. 22. *Lychnis wilfordii*, II M (Alpine Garden Society 1280). FIG. 23. *Silene keiskei*, I M (Mount Ho-o, Ozawa, s.n.). FIG. 24. *S. repens latifolia*, Diak. (Roberson, s.n.). FIG. 25. *S. struthioides*, Diak. (Bryan, s.n.). FIG. 26. *Silene* sp., Diak. (Stainton Sykes & Williams 8108). FIG. 27. *Silene* sp., I M (Stainton Sykes & Williams 8178). FIG. 28. *S. wrightii*, I M, Kruckeberg 4716. Diak., diakinesis; I M, first metaphase; II M, second metaphase.

Kruckeberg 4252. WASHINGTON. Chelan County: Basalt ridge above Liberty, *Kruckeberg 4209*; Icicle Creek, *Hitchcock 20190*. Okanogan County: between Twisp and Omak on Loup-Loup highway, *Kruckeberg 3274*; summit of Loup-Loup highway, *Kruckeberg 3276*; 5 miles west of Wauconda on highway to Republic, *Kruckeberg 3279*. Skamania County: 1 mile southeast of Timberline Camp on Timberline Trail, Mount Saint Helens, *Kruckeberg 3992*. Stevens County: summit of Chewelah ski lift on road to Chewelah Peak, *Kruckeberg 4052*; between ski lift summit and Chewelah Peak, on open ridges, *Kruckeberg 4057*.

SILENE GRAYI Wats. $2n=48$. CALIFORNIA. Trinity County: between Deer Creek basin and Deer Lake, Trinity Alps, *Kruckeberg 3759*; between Deer Creek Pass and Stonewall Pass, Trinity Alps, *Kruckeberg 3766*; 3.5 miles above Trinity Alps resort on Red Mountain trail below Stonewall Pass, *Kruckeberg 3772*.

SILENE HOOKERI Nutt. ex T. & G. $2n=72$. OREGON. Benton County: between Kings Valley and Wren, *Kruckeberg 2697*. Douglas County: 5 miles up Little River, south of Glide, *Cohen s.n.* Josephine County: peridotite alluvium bordering Whiskey Creek, 3 miles west of O'Brien, *Kruckeberg 3777*.

SILENE INVISA H. & M. $2n=48$. CALIFORNIA. Plumas County: rocky flats above Elwell Lake, Lakes Basin area, *Kruckeberg 2897b*; rocky swales above Upper Tamarack Lake, Sierra Buttes area, *Kruckeberg 3694*. Trinity County: wooded slope between Deer Creek basin and Deer Lake, Trinity Alps, *Kruckeberg 3759a*.

SILENE LACINIATA Cav. subsp. *MAJOR* H. & M. $2n=96$. CALIFORNIA. Los Angeles County: west of Beverly Glen Canyon on Mulholland Drive, Santa Monica Mountains, *Snow s.n.*; Turnbull Canyon, Whittier, *Raven s.n.* San Diego County: 0.5 mile east of Potrero Store along State Highway 94, *Walters s.n.* Santa Barbara County: Bishop Ranch, *Clarke s.n.*

SILENE LACINIATA Cav. subsp. *GREGGII* (Gray) H. & M. $2n=48$. ARIZONA. Apache County: at crossing of west fork Little Colorado River, between Greer and junction with Highway 73, *Kruckeberg 4608*. Cochise County: along Rustler Park road, Chiricahua Mountains, *Kruckeberg 3862*; rocky banks of Cave Creek, at Herb Martyr Forest Camp, Chiricahua Mountains, *Kruckeberg 3863*; between Rustler Park and Barfoot Lookout, *Kruckeberg 4643*; Crest Trail to Fly Peak, south of Rustler Park, Chiricahua Mountains, *Kruckeberg 4650*. Graham County: rocky slopes, 4 miles below Hospital Flats, Graham Mountains, *Kruckeberg 3878*. NEW MEXICO. Catron County: ten miles northeast of Collins Park on road to Datil, *Kruckeberg 4703*. Grant County: rocky slopes overlooking copper mines at Santa Rita, *Kruckeberg 4721*. TEXAS. Brewster County: between Boot Springs and pass overlooking Inner Basin, Big Bend National Park, *Kruckeberg 4776*.

SILENE LEMMONII Wats. $2n=48$. CALIFORNIA. Tulare County: above Lodgepole Camp on road to corral, Sequoia National Park, *Kruckeberg 3393*. Tuolumne County: grade east of Yosemite Creek along Tioga Pass Road, *Kruckeberg 3530*. Sierra County: along State Highway 89 at Calpine Lookout road, *Kruckeberg 3667*. Plumas County: woods at junction of Susanville and Lake Almanor roads, State Highway 89, *Kruckeberg 3702*. San Bernardino County: woods along road from South Fork of Santa Ana River to Barton Flats, *Kruckeberg 3846*.

SILENE MARMORENSIS Kruck. $2n=48$. CALIFORNIA. Siskiyou County: one mile north of Somes Bar on road to Camp Three, *Hitchcock 20221*, type.

SILENE MENZIESII Hook. $2n=24$. Diploid. CALIFORNIA. Fresno County: Jackass Meadows Forest Camp, below Florence Lake, *Kruckeberg 3436*. IDAHO. Custer County: 2 miles above Wild Horse Creek Forest Camp, *Kruckeberg 4265*.

SILENE MENZIESII Hook. $2n=48$. Tetraploid. OREGON. Wallowa County: Evergreen Forest Camp, upper Innaha River, *Kruckeberg 3120*. CALIFORNIA. Trinity County: upper end of Morris Meadows, Stuart Fork of Trinity River, Trinity Alps, *Kruckeberg 3746*. IDAHO. Valley County: lower Bear Valley at Poker Meadows Campground, *Kruckeberg 4192*. Custer County: Wild Horse Creek Forest Camp, *Kruckeberg 4292*. Bear Lake County: on tailings of phosphate mine, west slope of Snowdrift Mountain, *Kruckeberg 4527*. Custer County: 10 miles west of Challis, on talus of upper

Daugherty Gulch, *Kruckeberg 4542*. WASHINGTON. Chelan County: 1 mile east of U. S. Highway 10 on State Highway 15C to Lake Wenatchee, *Kruckeberg 3259*. Kittitas County: along Swauk Creek, $\frac{1}{8}$ mile below Liberty Guard Station, *Kruckeberg 3010*; base of Iron Peak trail, North Fork Teanaway River, *Kruckeberg 3289*. Okanogan County: rocky alluvium of Methow River, 2 miles below Mazama, *Kruckeberg 3273*; Sweat Creek Forest Camp, 7 miles west of Republic, *Kruckeberg 3283*. Stevens County: along trail between Calispell Meadows and Calispell Peak, *Kruckeberg 4081*.

SILENE MONTANA Wats. 2n=48. CALIFORNIA. Tuolumne County: along Tioga Pass road between Tamarack Flats and Yosemite Creek, *Kruckeberg 3529*. Shasta County: between Chaos Jumbles and Noble Pass, Lassen Volcanic National Park, *Kruckeberg 3713*. OREGON. Klamath County: slopes above Rim Drive, 3 miles above Park Headquarters, Crater Lake National Park, *Kruckeberg 3780*. NEVADA. Ormsby County: along U. S. Highway 50, east of Spooner Summit, 10 miles west of Carson City, *Kruckeberg 3652*.

SILENA NUDA (Wats.) H. & M. 2n=48. CALIFORNIA. Sierra County: 1 mile east of Calpine on road to Beckwourth, *Kruckeberg 3664*. Plumas County: 1 mile west of Portola along U. S. Highway 40, *Kruckeberg 3669*; 3 miles northwest of Lake Almanor along State Highway 89, *Kruckeberg 3700*.

SILENE NUDA (Wats.) H. & M. subsp. INSECTIVORA (Hend.) H. & M. 2n=48. OREGON. Klamath County: Sprague River valley, 7.5 miles west of Bly along State Highway 66, *Kruckeberg 4030* (type locality).

SILENE OCCIDENTALIS Wats. 2n=48. CALIFORNIA. Sierra County: timbered rocky flats between Sand Lake and Packer Lake, Sierra Buttes area, *Kruckeberg 3696*.

SILENE OREGANA Wats. 2n=48. IDAHO. Valley County: Lodgepole pine flats 5 miles west of McCall on highway to New Meadows, *Kruckeberg 4151*.

SILENE PARISHII Wats. 2n=48. CALIFORNIA. San Bernardino County: Grout Bay, Big Bear Lake, *Everett 8248*, *Kruckeberg 3831*; 2 miles above road's end, along trail to Mount San Gorgonio, *Kruckeberg 3848*.

SILENE PARRYI (Wats.) H. & M. 2n=48. Tetraploid. IDAHO. Bear Lake County: open, west-facing slopes of Snowdrift Mountain, *Kruckeberg 4520*. WASHINGTON. Chelan-Kittitas County line: Mount Lilian, eastern Wenatchee Mountains, *Kruckeberg 3229*, *3232*. Stevens County: between head of ski lift and summit, Chewelah Peak road, *Kruckeberg 4056*; $\frac{3}{4}$ mile below lookout, Chewelah Peak, *Kruckeberg 4064*; southwest-facing slopes of Calispell Peak, *Kruckeberg 4072*; open ridge $\frac{3}{4}$ mile south of Calispell Peak, *Kruckeberg 4079*. MONTANA. Flathead County: east slopes of Mount Aeneas, Swan River Range, *Kruckeberg 4306*. Glacier National Park: just south of Logan Pass, on rocky ledges of "Hanging Gardens," *Kruckeberg 4340*. CANADA. Waterton Lakes National Park, Alberta: east-facing slope above upper Carthew Lake, on trail between Cameron Lake and Waterton Lake, *Kruckeberg 4366*.

SILENE PARRYI (Wats.) H. & M. 2n=96. Octoploid. WASHINGTON. Clallam County (Olympic National Park): at Idaho Shelter, Hurricane Ridge, *Kruckeberg 2776*, *4045*; along ridge to Mount Angeles, *Kruckeberg 2792*; along trail to Moose Lake from Obstruction Point, *Kruckeberg 4048*. Kittitas County: alluvial flats at Fish Lake, upper Cle Elum River, *Kruckeberg 3221*; at base of Iron Peak trail, North Fork of Teanaway River, *Kruckeberg 3288*; along upper reaches of Miller Peak trail, *Kruckeberg 3967*.

SILENE PETERSONII Maguire. 2n=96. UTAH. Garfield County: on slopes of red talus and clay, 5.5 miles east of U. S. Highway 89, on Red Canyon road to Bryce Canyon National Park, *Kruckeberg 3904*. Iron County: limestone clay along west-facing rim of Cedar Breaks, *Kruckeberg 3908*.

SILENE REPENS Patrin. subsp. AUSTRALE H. & M. 2n=24. Diploid. IDAHO. Custer County: Boulder Creek, 5 miles above Wildhorse Creek Canyon, *Kruckeberg 4286a*; Boulder Creek basin, 0.5 mile below Boulder Lake, *Kruckeberg 4290*.

SILENE SARGENTII Wats. 2n=48. CALIFORNIA. Fresno County: pass between upper Bear Creek Meadow and Rose and Marie Lakes, *Kruckeberg 3459*; at Marie Lake,

Kruckeberg 3482. Shasta County: near summit of Lassen Peak, Lassen Volcanic National Park, *Kruckeberg 3711*.³

SILENE SCAPOSA Robins. 2n=48. OREGON. Harney County: 1 mile north of Squaw Butte on dirt road to U. S. Highway 20 (Burns-Bend highway), *Kruckeberg 4031*.

SILENE SCOULERI Hook. 2n=48. IDAHO. Benewah County: between Tensed and Potlatch on U. S. Highway 95, *Kruckeberg 4085*.

SILENE SPALDINGII Wats. 2n=48. WASHINGTON. Garfield County: near Colton, *Daubenmire s.n.*

SILENE THURBERI Wats. 2n=48. ARIZONA. Cochise County stony alluvium along Cave Creek at Herb Martyr Forest Camp, Chiricahua Mountains, *Kruckeberg 3863*.

SILENE VERECUNDA Wats. subsp. VERECUNDA 2n=48. CALIFORNIA. San Francisco County: rocky soil at east end of summit ridge of Mount Davidson, *Raven s.n.*

SILENE VERECUNDA Wats. subsp. ANDERSONII (Clokey) H. & M. 2n=48. NEVADA. Clark County: rocky alluvium of Kyle Creek canyon, 1 mile below Charleston Park, Charleston Mountains, *Kruckeberg 3915*.

SILENE VERECUNDA Wats. subsp. PLATYOTA (Wats.) H. & M. 2n=48. CALIFORNIA. Tulare County: Last Chance Meadows area, Sierra Nevada Range, *Kruckeberg 3345*; 7 miles above California Hot Springs on road to Johnsdale, *Kruckeberg 3392*; 5 miles west of Hockett Meadows, Sequoia National Park, *Kruckeberg 3422a*. Los Angeles County: north slope of Mount Waterman, San Gabriel Mountains: *Kruckeberg 3821*; Horse Flats, San Gabriel Mountains, *Kruckeberg 3822*; north-facing slopes of Blue Ridge, San Gabriel Mountains, *Kruckeberg 3916*. San Bernardino County: 5 miles below Lake Arrowhead on State Highway 18; flats above Moon Ridge, south side of Bear Valley on road to south fork Santa Ana River, *Kruckeberg 3840* (eglandular form); near summit of Sugarloaf Ridge, 6 miles southeast of Bear Valley, *Kruckeberg 3843* (eglandular form). Riverside County: 3.4 miles south and east of State Highway 74, Bautista Canyon, *Vasek s.n.*

SILENE WILLIAMSHI Britt. 2n=24. ALASKA. Slopes of Shaw Creek, Richardson Highway, *Gjaerevoll 1444*; heath, Donnelly Dome, Alaska Range, *Gjaerevoll 1284*.

SILENE WRIGHTII Gray. 2n=96. NEW MEXICO. Grant County: in crevices of massive boulders at base of sheer rock cliffs, overlooking copper mines at Santa Rita, *Kruckeberg 4716*.

EASTERN NORTH AMERICAN SPECIES

SILENE ANTIRRHINA L. 2n=24. MISSOURI. Jasper County: near Webb City, *Palmer s.n.*

SILENE CAROLINIANA Walt. 2n=48. NORTH CAROLINA. Franklin County: 9 miles east of Wake Forest, granitic "flat-rock" area, *Channell s.n.* Orange County: Chapel Hill, *Bell s.n.*

SILENE CAROLINIANA Walt. subsp. WHERRYI (Small) Clausen. 2n=48. Garden culture: Larchmont, New York, *Epstein s.n.*

SILENE POLYPETALA (Walt.) Fern. and Schub. 2n=48. GEORGIA. Talbot County: north of county bridge, hillside above Flint River, *Galle s.n.*

SILENE REGIA Sims. 2n=48. MISSOURI. Dade County: near South Greenfield, *Palmer s.n.* Newton County: George Washington Carver National Monument, *Palmer s.n.*

SILENE ROTUNDIFOLIA Nutt. 2n=48. TENNESSEE. Marion County: crevices of the "Chimneys," gorge of Pocket Creek, Whitwell Pocket area, *Sherman s.n.*

SILENE STELLATA (L.) Ait. [including *S. scabrella* (Nieuwl.) Palm. and Steyer.] 2n=48. INDIANA. Starke County: *Jackson s.n.* MISSOURI. Newton County: near Diamond, George Washington Carver National Monument, *Palmer s.n.* KANSAS. Riley County: 40 miles east of Aurora, woods along Fancy Creek, *Fraser*. WEST VIRGINIA. Monongalia County: on Permian shale banks, vicinity of Morgantown, *Constable & Core s.n.* LOUISIANA. northwestern portion of state, *Dormon s.n.*

³ Plants intermediate between *S. sargentii* and *S. Suksdorfii* Robins.

SILENE SUBCILIATA Robins. $2n=48$. LOUISIANA. "Western Louisiana," *Dormon s.n.* (garden culture).

SILENE VIRGINICA L. $2n=48$. NORTH CAROLINA. Wake County: 18 miles north of Raleigh, across the Neuse River, on State Highway 50, *Smith s.n.*

SPECIES OUTSIDE CONTINENTAL NORTH AMERICA

LYCHNIS WILFORDII Maxim. $2n=24$. JAPAN: Garden culture, *M. Ozawa s.n.*; garden culture, *Alpine Garden Society 1280*.

PETROCOPTIS PYRENAICA Braun. $2n=24$. EUROPE. Garden culture, *Museum of Natural History, Paris s.n.*

SILENE KEISKEI Miq. $2n=24$. JAPAN: Mt. Ho-o, *M. Ozawa s.n.*; Mt. Kitadake, *Ozawa s.n.*

SILENE REPENS Patrin, var. LATIFOLIA Turcz. $2n=48$. JAPAN: Garden culture, *Mrs. L. N. Roberson s.n.*; garden culture, *Epstein s.n.*

SILENE STRUTHIOLOIDES Gray. $2n=24$. HAWAII. Hawaii: near the Kilauea Crater, Hawaii National Park, *Bryan s.n.*

SILENE species. $2n=24$. NEPAL: Tegar, north of Mustang, *Sykes & Williams 8108*; Larjung, south of Tukucha, Kali Gandaki Valley, *Sykes & Williams 8178*.

Department of Botany,
University of Washington, Seattle

LITERATURE CITED

HITCHCOCK, C. L., and B. MAGUIRE. 1947. A revision of the North American species of *Silene*. Univ. Wash. Publ. Biol. 13:1-73.

KRUCKEBERG, A. R. 1954. Chromosome numbers in *Silene* (Caryophyllaceae): I. *Madroño* 12:238-246.

———. 1955. Interspecific hybridizations of *Silene*. *Am. Jour. Bot.* 42:373-378.

———. 1960. A new *Silene* from northwestern California. *Madroño* 15:172-177.

A NEW SPECIES OF ZINNIA FROM MEXICO

A. M. TORRES

During the course of a cytotaxonomic study of the genus *Zinnia* (Compositae), plants started from seeds kindly provided by Dr. Jerzy Rzedowski of the Universidad Autónoma de San Luis Potosí, México, were cultivated in the greenhouses of Indiana University. One collection, when grown to maturity, proved to be a new species known thus far only from the area where the seeds were collected.

Zinnia citrea sp. nov. Planta perennis, caespitosa, ad 2 dm. alta; caulis viridibus, strigosis; foliis oppositis, amplexicaulis, uninervis, linearibus, ad 3.5 cm. longis, 0.8-1.9 mm. latis, sparse strigosis aut glabrescentibus, sparse glanduloso-punctatis; capitulis terminatis in pedunculis 0.8-2.0 cm. longis, subhemisphaericis, 0.4 cm. latis 0.5 cm. altis; phyllariis oblongis, firme-gradatis, herbaceis, minuto-glanduliferis, apicibus obtusis, ciliatis; radii ca. 7, chloreis oblongis, ad 0.8 cm. longis 0.5 cm. latis, sine tubo, in dorso viridis nervis, apicibus 0.3 lobis; achaeniis radorum oblanceolatis, ad 4.2 mm. longis, tuberculatis, nigrescentibus, sine aristis; floribus disci ca. 22, tubis 3.1 mm. longis, lobis 1.4 mm.